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Stephen Kabwe, Steven Longabaugh, Nicholas Sitko and David Tschirley

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ABSTRACT

This paper traces the trajectories of successful commercial smallholders operating under differing sets of market institutions. Analysis focuses on maize, cotton and horticulture, three widely marketed crops with strikingly different market institutions. Maize receives intensive government input and marketing support. In contrast, cotton relies primarily on private contract farming schemes, while horticulture enjoys no large-scale institutional support from either the public or private sectors. Using a mix of quantitative and qualitative methods, the analysis aims to identify personal characteristics and institutional factors that enable smallholder transitions to high-productivity commercial agriculture.

The study concludes that only a small minority of Zambian smallholder farmers succeed in transitioning to high-productivity, high-volume commercial agriculture. Only about 20% of cotton farmers and less than 5% of maize and horticulture farmers succeed as top-tier commercial growers.

By tracing the long-term agricultural trajectories of successful commercial smallholders, the paper identifies two broad agricultural pathways out of poverty. The low road, exemplified by cotton production, involves a two-generation transition via low-value but with well-structured markets. The more restrictive high road, epitomized by horticulture production, offers a steeper ascent, enabling prosperity within a single generation, but requires commensurately higher levels of financing, management and risk.

INTRODUCTION

The process of agricultural transformation involves a shift from low-productivity, subsistence farming to high-productivity, commercial agriculture. These changes in agriculture, in turn, trigger sweeping structural changes that ripple through the broader economy. At the macro level, agricultural transitions pave the way for economic diversification into services and manufacturing. At the household level, commercialization enables agricultural specialization as well as diversification into nonfarm activities. Spatially, agricultural productivity growth and commercialization contribute to increasing geographic concentration of population and economic activity in urban centers. The widely varying institutional contexts within which agricultural transitions unfold help to shape agricultural trajectories, with consequently important implications for rural households and the macro economy.

Commercialization and agricultural productivity advance hand in hand during this transition. Productivity gains enable farmers to generate surpluses for sale and reduce unit production costs. Market access provides the conduit for monetizing productivity gains, permitting household specialization and kick starting the structural transformation process. Yet one component without the other will not suffice. Productivity gains without markets lead to temporary production surges and price collapses. Markets without increased farm productivity remain moribund, with farm households unable to generate surpluses for sale at competitive prices.

As a result, two sets of institutions become crucial for stimulating agricultural growth – those that affect farm productivity and those governing market development. In practice, substantial variations in the structure of farmer organizations, in the political power of farm and agribusiness lobbies and in governments' propensity to intervene in agricultural markets give rise to a wide variety of leading actors and institutional arrangements driving successful agricultural growth trajectories (Mosher 1965, World Bank 2008, Haggblade and Hazell 2010). Some governments prefer public management of agricultural input and output markets (Kherallah et al. 2002). Others supply public goods such as research, roads regulatory frameworks and then let private agribusinesses manage market transactions. Over time, agricultural policies and institutions change – sometimes abruptly (Jayne et al. 2002). Emerging commercial farmers must, therefore, continuously adjust to changing circumstances as they navigate the pathway to higher productivity commercial agriculture.

To understand how differing institutional frameworks influence farmer opportunities and agricultural trajectories, this paper examines three commercial crops – maize, cotton and horticulture – with widely different institutional support systems. Discussion focuses on Zambia, where a rich institutional landscape offers widely contrasting models and where detailed rural household survey data facilitate empirical exploration of smallholder trajectories. Zambia's maize, cotton and horticulture farmers all enjoy large commercial markets. But market structures, credit systems, extension support and government policies all differ markedly. By tracing smallholder transitions within each commodity subsector, this paper aims to understand the processes under way and to compare alternative institutional models for increasing agricultural productivity and commercialization. Using a mix of quantitative and qualitative methods, the analysis aims to identify personal characteristics and institutional factors that enable smallholder transitions to high-productivity commercial agriculture. In doing so, the paper traces two broad agricultural pathways out of poverty: a low road, involving a two-generation transition via low-value but well-structured markets, and a more restrictive high road, which offers a steeper ascent, enabling prosperity within a

single generation, but requiring commensurately higher levels of financing, management and risk.

DATA AND METHODS

This paper focuses on three widely marketed crops with contrasting institutional support systems (Table 1). Maize, the dominant food crop in Zambia, has received intensive government input and marketing support since the 1930's. In contrast, cotton, the country's largest cash crop, relies primarily on privately financed contract farming schemes. Two large private ginning companies and half a dozen smaller competitors supply inputs on credit to smallholder cotton farmer as well as a guaranteed market for outputs. Horticulture production for domestic markets offers the largest high-value agricultural market in Zambia. But unlike cotton and maize, no large-scale institutional support system exists. Instead, a battery of small and medium-scale farmers finance their own inputs, organize transport and negotiate markets with private traders and brokers. Despite strikingly different market institutions, all three commercial systems have grown rapidly over the past four decades. This paper compares the performance of successful commercial farmers operating under each of these three differing institutional systems, using both quantitative and qualitative methods.

[Table 1 here]

Quantitative analysis of commercial maize, cotton and horticulture farming revolves around three nationally representative household surveys conducted in 2001, 2004 and 2008 by Zambia's Central Statistical Office (CSO) in conjunction with the Ministry of Agriculture and Livestock and Michigan State University. This supplemental post-harvest survey provides representative coverage of Zambia's 1.6 million small and medium-scale farm households, defined as those farming less than 20 hectares of land. The survey covered the 1999/00, 2002/03 and 2006/07 crop years, collecting information on household cropping patterns, landholdings, assets, crop output, livestock production and marketed sales. Of the 6,845 households interviewed in 2001, 5,342 were successfully re-interviewed in 2004 and 4,284 in 2008. As a result, these surveys provide a panel data set of about 4,300 households which enables assessment of variations in production and sales behavior over a seven-year time span.

To contextualize and extend the themes emerging from this quantitative analysis, the study team conducted a set of qualitative field interviews with 90 commercial maize, cotton and horticulture farmers operating in three different regions of Zambia. These qualitative interviews enabled the team to trace the full life histories of individual farmers. Moving well beyond the seven-year window provided by the panel survey, these life history interviews examined initial endowments, start-up conditions and the evolution of production and commercial strategies over time, including multi-generational dimensions of smallholder trajectories from the parents of current farm household heads through to their children.

The qualitative interviews began in Mumbwa District, 140 kilometers west of Lusaka, in a region where large numbers of smallholder farmers grow and market all three crops. There, our team interviewed 45 farmers, targeting equal numbers of cotton, maize and horticulture farmers during the months of September and October 2011. Local agricultural extension officers helped the team to identify successful commercial farmers growing each of the three crops. Then, in February 2012, the team traveled to the horticultural production zones surrounding the capital city of Lusaka, in peri-urban Lusaka West and in nearby Chongwe

District, 40 kilometers east of Lusaka, where an unusually high density of horticulture farmers grow produce for the Lusaka market. Because our team members have been conducting thrice-weekly monitoring of the Soweto wholesale vegetable market in Lusaka over the past six years, they were able to identify a cohort of 25 regular commercial smallholders supplying the Lusaka market and trace them back to their farms to conduct life history interviews. Following the Chongwe field interviews, during the second week of February 2012, the team travelled to Eastern Province of Zambia, home to the highest density of cotton farming in Zambia (see Figure 2), to conduct interviews with 20 successful commercial cotton farmers. Buyers for the two major cotton companies helped the team to identify successful cotton farmers in the zones around Lundazi, Chipata and Katete. These qualitative field interviews aimed to provide a more organic understanding of the life histories of commercial smallholders, the institutional and individual factors enabling some to scale up commercial operations successfully and the influence this has on household livelihood strategies and welfare trajectories.

CONTRASTING INSTITUTIONAL TRAJECTORIES

Very different institutional structures have shaped the commercial growth of maize, cotton and horticulture. Both maize and cotton marketing began under the direct control of government parastatals during the two and a half decades of heavy government involvement in agricultural markets in the early post-independence years from 1964 through about 1990. Large recurring deficits among the parastatals forced a subsequent period of liberalization during the structural adjustment decade of the 1990's. For maize markets, this liberalization proved transitory, with government resuming large-scale involvement in maize input and output markets beginning in the early 2000s. Cotton marketing, however, has remained in private sector hands since liberalization in the early 1990's. In contrast, horticulture crops have not experienced direct government marketing controls, because of their much higher value, higher input cost and perishability. As a result, private farmers, brokers, traders and retailers have consistently organized Zambia's commercial horticulture markets. The following overview fleshes out these differing institutional trajectories in greater detail.

Maize

Maize, the country's principal food staple, has been highly politicized and heavily subsidized since the 1930's (Smale and Jayne 2010). From independence, in 1964, the National Agricultural Marketing Board (NAMBOARD) supplied subsidized seeds and fertilizer on credit as well as a guaranteed market outlet for maize at a fixed, pan-territorial price. Subsidy schemes promoted animal traction and tractor plowing throughout Zambia (Wood et al. 1990; Kokwe 1997). To support these efforts, the government established a Cooperative Credit Scheme (CCS) and an Agricultural Finance Company, which later became the Lima Bank, for purposes of financing the agricultural sector on subsidized terms. Most of their lending focused on maize (MACO 2004).

Recurring heavy losses led to the de facto bankruptcy of Zambia's many parastatals by the late 1980's. At NAMBOARD alone, losses accounted for 16% of government spending by the early 1990s (Howard and Mungoma 1996). Under heavy donor pressure, government abolished NAMBOARD in 1990 (Smale and Jayne 2010). With the liberalization of agricultural markets, maize became the province of private traders and cooperative societies. The CCS and Lima Bank similarly folded up their operations, leaving a vacuum in agricultural financing since the mid-1990's (MACO 2004). At the same time, the volumes of

subsidized fertilizer distributed through government channels diminished steadily as donor support withdrew. Rising fertilizer prices, coupled with the removal of subsidized NAMBOARD prices, led to a sharp contraction in farm-level maize profitability. As a result, maize production fell perceptibly as farmers reverted to production of alternate food crops such as cassava, groundnuts and sweet potatoes and to cash crop such as tobacco and cotton (Zulu et al. 2000).

But the government withdrawal from Zambia's maize markets proved short-lived. After a decade-long absence, the Zambian government resumed active trading in maize markets, beginning with the creation of a new Food Reserve Agency (FRA) in 2003/1995. In recent years, the FRA has paid roughly a 30% premium over the prevailing market price (Mason and Myers 2011). Despite the high cost to Zambia's Treasury, the FRA's presence in Zambia's maize market has grown since its inception, culminating in the 2010/11 crop year with the purchase of 880,000 tons of maize, amounting to over 80% of smallholder maize sales (Mason et al. 2011). The Zambian government has likewise resumed large-scale distribution of subsidized fertilizer through the Fertilizer Support Programme and its successor, the Farmer Input Support Programme (FSP/FISP). In recent years, subsidized FSP fertilizer has accounted for about one-third of fertilizer used by maize producers in Zambia (Chapoto et al. 2012). The resumption of fertilizer subsidies and large-scale government maize purchases at subsidized prices have helped to stimulate a resurgence in smallholder maize production since the mid-2000's (Figure 1).

[Figure 1 here]

Cotton

Like maize, Zambia's cotton market remained under tight parastatal control during the early independence years. From its formation in 1977 until its demise in 1994, the Lint Company of Zambia (LINTCO) managed all facets of cotton production and marketing in Zambia. At planting time, LINTCO provided certified seed, pesticides, sprayers and extension support to farmers. At harvest, LINTCO purchased all cotton at a fixed price. Although LINTCO succeeded in initiating commercial cotton production in Zambia, like NAMBOARD it incurred heavy recurrent losses which forced government to disband the company and sell off all corporate assets.

Two private ginning companies purchased the LINTCO assets. London-based Lonrho purchased the ginneries in central and southern Zambia, while South Africa's Clark Cotton purchased LINTCO's equipment and facilities in the east, leading to a duopoly in the early years of privatization. Unlike maize, cotton marketing has remained fully privatized since liberalization in 1994, despite several significant boom and bust periods. A recent review traces five distinct phases since the privatization of LINTCO: • a *post-reform boom* (1995-1998) when the sector remained heavily concentrated and expanded rapidly; • the *first crash* (1999-2000), marked by a severe credit default crisis, brought on in part by the entry of new, small ginners and cotton buyers committed more to trading cotton than to promoting its production; • a *second boom*, (2000-2005) when innovation by the two leading companies reduced credit default; followed by • a *second crash* (2006 – 2007), triggered by a sharp appreciation of the kwacha, mounting conflict between farmers and ginners, the entry of additional firms in the sector and another serious credit default crisis (Tschirley and Kabwe 2010, p.5). Since 2010, rising world cotton prices have resulted in renewed strong incentives to grow cotton. As a result, Zambia's cotton production has resumed its upward trajectory (Figure 1).

In 2012, Zambia's cotton sector retains its two market leaders, Dunavant (formerly Lonrho) and Cargill (formerly Clark) as well as half dozen smaller players. The industry leaders supply input packs on credit to their farmers, as do some of the smaller competitors. The larger companies also provide regular extension services and training at critical periods during the cropping season. In return, the farmers contract to sell all of their cotton production to their parent ginneries. The ginneries deduct input costs and interest charges at harvest time, remitting the net profit in cash or bank transfer to their farmers.

Horticulture

A large network of independent private traders, brokers, input dealers and farmers manage Zambia's horticulture trade. They concentrate primarily in central Zambia and in the Copperbelt, in close proximity to the urban markets along the line of rail. Three main products – tomato, rape (kale), and cabbage – account for about 75% of smallholder sales of horticulture products.

Horticulture farmers generally sell their produce through urban wholesale markets. In most wholesale markets, a network of private brokers control access and facilitate farmer offloading in return for a commission. City councils and marketer cooperatives manage the urban wholesale market infrastructure, although disputes over market fees and access have erupted periodically in recent years. Horticulture retail markets in Zambia are dominated by open air markets and street vendors, which account for over 90% of all fresh produce marketed. Currently, supermarkets handle only about about 5% of horticulture retailing (Hichaambwa and Tschirley 2006, Tschirley and Hichaambwa 2010).

Unlike cotton, individual horticulture farmers must self-finance input purchases and manage marketing themselves. Heavy disease pressure during the rainy season necessitates the use of fungicides and insecticides as well as investments in dry season irrigation equipment. Despite risks related to product perishability and price volatility, steadily increasing urban incomes have underpinned rapid growth in Zambia's highly lucrative horticulture markets over the past several decades.

A PROFILE OF COMMERCIAL SMALLHOLDERS

Commercial production

Roughly 70% of Zambia's labor force works in agriculture, on one of the country's 1.6 million small farms and roughly 1,000 large farms. Yet only about 25% of smallholder maize farmers sell maize, while roughly 20% sell horticulture products and 10% to 20% sell produce and sell cotton, depending on the year (Table 2).

[Table 2 here]

Commercial production remains highly concentrated among a small segment of rural households. For both maize and horticulture, less than 5% of growing households account for half of all marketed sales (Table 2). In contrast, cotton production and sales are distributed more evenly across the population of growers. About 20% of cotton growers account for the top half of sales because widespread input credit from the ginneries makes cotton production accessible to even poor households without large financial resources.

Cotton farmers are the poorest of the high-volume commercial smallholders. Despite equivalent crop income, they earn less than half as much nonfarm income as maize and horticulture farmers (Table 3). This relative shortage of nonfarm earnings may explain their attraction to cotton farming, which requires no self-financing of purchased inputs.

[Table 3 here]

Farm productivity

Increased productivity goes hand in hand with agricultural commercialization. The most commercially oriented maize farmers attain maize yields of 3 tons per hectare, compared to roughly 2 tons for the bottom half of sellers and only 1 ton for the non-sellers (Table 4). Similarly, the top selling cotton farmers achieve yields roughly double those of the bottom half. Among horticulture producers, the productivity differential is even more startling: over 10 times higher for the top half than for the bottom half of sellers. Unlike low-value crops such as cotton and maize, for which farm-gate prices are roughly equivalent across farms, horticulture growers earn significantly higher output prices but experience far greater price variability, due to differing product mixes, quality and timing. The best horticulture farmers tilt their product mix towards the highest value crops such as tomatoes. As a result, average horticulture farmers produce per hectare crop values two to three times higher than those achieved by cotton and maize farmers. Among the top tier commercial sellers, farmers specializing in horticulture earn per hectare revenues over ten times higher than top tier cotton and maize growers (Table 4).

[Table 4 here]

Land productivity differentials of this magnitude stem from a combination of higher input use, higher-value crop mixes and better management practices. The top commercial maize farmers achieve higher yields by applying four times as much mineral fertilizer and twice as much hybrid seeds as average farmers (Table 4).

In contrast, cotton farmers use standard input packs provided on loan by the cotton ginneries. So yield differentials among cotton farms stem primarily from superior farm management practices. Early land preparation, early planting, careful weeding and pest control, long-term build-up of soil organic material, and the adoption of minimum tillage systems that enable water harvesting during the sporadic rainfall common in the semi-arid cotton belt all emerge as critical variables in raising per hectare cotton yields (Haggblade and Tembo 2003).

Horticulture farmers apply all three tools for raising land productivity. They select a high-value crop mix. They apply expensive inputs, including improved seeds, hybrid seedlings, pesticides, fungicides, fertilizer and irrigation water. In comparison with cotton input costs of \$30 per hectare and maize input costs of \$260 per hectare, horticulture farmers apply inputs costing \$400 to \$4,400 per hectare, all financed from personal income sources (Table 5). Successful horticulture farming likewise requires exceptional management, including rigorously precise agronomic practices, careful pest management and disease control, assiduous labor management to ensure product quality, and strong financial management. For those who succeed, the result is per hectare returns an order of magnitude higher than those earned in commercial cotton and maize production (Table 4).

[Table 5 here]

Geographic concentration

Commercial cotton and maize farming occurs across the semi-arid central and southern parts of Zambia. While maize is grown throughout Zambia, cotton is most heavily concentrated in eastern Zambia (Figure 2).

[Figure 2 here]

In contrast, commercial horticulture production tends to concentrate in close proximity to major urban centers and along major transport routes leading to them. Monitoring of Lusaka's largest wholesale market confirms that highly perishable products such as tomatoes and rape come primarily from nearby. Distance to market averages about 44 kilometers for rape and 69 kilometers for tomatoes (Tschirley and Hichaambwa 2010). Thus, location is a key variable governing farmer access to high-value horticulture markets.

Factors affecting successful commercialization

The quantitative data from our national panel survey allow us to formally explore factors associated with successful commercialization. Using these data, we estimate the probability of becoming a top-tier commercial producer as a function of several sets of exogenous variables: characteristics of the household head, social capital, asset endowments, location and management skills. By pooling panel data from the three survey years, we are able to estimate Probit regressions including lagged asset variables to test propositions about the importance of asset endowments for commercial production. The results, reported in Table 6, suggest several general conclusions.

[Table 6 here]

Farm assets. The characteristics of top-tier commercial cotton and maize farmers appear to differ significantly from those who succeed in horticulture. The most successful cotton and maize farmers are more likely to be male-headed, with larger endowments of productive assets such as land, cattle, farm equipment and vehicles. Among the top commercial horticulture farmers, land holdings do not emerge as statistically significant. Because horticulture production generates per-hectare earnings an order of magnitude larger than cotton or maize, horticulture producers can become affluent on relatively small land holdings.

Location. Not surprisingly, successful horticulture growers are most likely to be found in districts nearby the major cities of Lusaka, Kitwe and Chipata. For maize producers, the negative and statistically significant coefficient on distance to an FRA depot suggests that proximity to an FRA buying station increases the likelihood of commercial success.

The migration variable, measured by years living in the current rural locality, proves significantly negative only for horticulture production. Though small in absolute value, this result suggests that top horticulture producers are more likely than others to relocate in order to find suitable sites endowed with water and market access. Indeed, our qualitative interviews reinforce this notion of mobility among successful horticulture producers.

Management. Our qualitative interviews repeatedly highlighted the importance of management skills. To test this proposition formally, we have used plot-level information,

available only for cotton and maize producers, to estimate production functions using purchased inputs, land preparation methods, weed management, and rainfall as explanatory variables. The residuals from these production functions have been used in the Probit regressions as a proxy for the management skills of individual farmers. For both cotton and maize, these residuals are strongly positive. With cotton farming, number of years as a cotton farmer reinforces the notion that management skills affect commercial success.

These results, while suggestive, rely on the short seven-year window available from the panel survey and fail to reveal how successful households managed to accumulate their key productive assets in the first place. For that, we must turn to the qualitative life histories for illumination.

LIFE HISTORIES OF SUCCESSFUL COMMERCIAL SMALLHOLDERS

The following discussion draws primarily on our qualitative life history interviews with successful maize, cotton and horticulture farmers. It summarizes their observations about how differing endowments, decisions and institutional frameworks affected their livelihood trajectories and enabled them to become successful commercial smallholders.

Alternate trajectories to high-productivity, commercial agriculture

Our interviews identify two routes available to rural households seeking an agricultural pathway out of poverty.¹ Conceptualize a mountain, whose altitude represents productivity per unit of family labor. To chart an agricultural pathway out of poverty, higher labor productivity is necessary to raise per capita incomes, enable households to free their children from farm labor obligations, deploy oxen or hired labor in their stead and finance school fees, livestock investments and financial savings that enable households to survive market downturns. Farm households can increase family labor productivity through intensification (either higher input use, better management or a move to high-value commodities) as well as through mechanization and expansion of cultivated area. The most successful commercial smallholders seek to raise labor productivity in all of these ways (Table 4). Beginning at the bottom of the mountain, rural households mired in poverty seek feasible pathways upwards. In general, successful exits follow one of two broad trajectories.

Low road. The low road traces a slow, gradual pathway up the mountain, often requiring two generations. Exemplified by cotton production, the low road involves low value farm output and low cash input costs. Given widespread input lending from ginning companies, cotton provides an entry point for large numbers of poor farmers with little nonfarm income. The ginning companies likewise provide extension support as well as highly localized pick-up points for collecting the cotton crop. As a cotton farmer from Mumbwa told us, “I am able to grow 10 hectares of cotton because I don’t need to have money for inputs as the outgrower company provides all I need on credit, including extension advice.”

Although many poor farmers try out cotton farming, not all of them succeed. Successful cotton production demands careful crop management, including timely planting, prompt weeding,

¹ The rich literature on poverty traps identifies a litany of geographic, individual and institutional factors that conspire to prevent sustained upward trajectories for some households (Barrett and McPeak 2005, Carter and Barrett 2006). This paper does not delve into the predicaments confronting this group. Rather, it focuses on farm households that manage to gain a foothold onto one of two feasible pathways up the mountain.

regular insect monitoring, repeated spraying and multiple rounds of hand picking to ensure proper fiber length and quality. Given these stringent management demands, only the most disciplined smallholders succeed. Financial management is equally important. Because annual crops such as cotton result in a single lump-sum cash payment, successful cotton production requires careful budgeting, cash management and financial savings. As a result, successful cotton farmers must be good financial managers as well as good farmers. Underlining the importance of both skill sets, one cotton farmer told us, “I plan for my farming business and make sure to plant early.”

Even the best managers grow their cotton business slowly over time. As a result, the low road typically requires two generations. Although low value crops such as cotton cap farm earnings at modest levels, successful farmers use cotton revenues to finance asset accumulation, entry into higher-input agriculture and education for their children, thus opening new pathways to high-wage nonfarm employment for the next generation. Through investments in education, they position their children to take next major step up the mountain. Indeed, most of the successful cotton farmers we interviewed insisted that their children not work in the fields but that they go to school instead. As one farmer told us, “Cotton is the only crop that allows me to educate my children.”

Currently, cotton farming offers the largest on-ramp to the low road up the mountain. In the 2011/12 season, over 200,000 Zambian farmers grew cotton. Given this scale, cotton currently serves as the largest filter in the agricultural system, widely accessible to even the very poor but highly demanding and unforgiving of mismanagement or indiscipline. Cotton provides poor but disciplined farmers a chance to audition and try out commercial farming. Top-tier cotton farmers farm only one-third as much land as top-tier maize farmers (Table 4). As a result, over 20% of the top cotton farmers are able to manage their cotton fields with family labor and hand hoes (Chapoto et al. 2012).

Commercial maize production, in contrast, does not generally provide a feasible on-ramp for the poor. Although maize, like cotton, is a low-value annual crop, unlike cotton commercial maize production imposes high input costs for fertilizer and seeds. Even with a 50% government subsidy on FSP fertilizer, maize input packages require up-front cash expenses of \$150 per hectare, compared to zero cash required for cotton input packages which are widely available on loan. Moreover, because of its sensitivity to moisture stress, rainfed maize production involves higher production risk than cotton during drought years. For the majority of rural Zambians, who farm less than two hectares of land, low-value maize is an unlikely candidate for lifting them from semi-subsistence to commercial affluence.

Although maize does not offer an on-ramp for the very poor, it does offer an optional low road for households wealthy enough to finance its high input costs. Mid-career farmers with significant nonfarm savings or successful cotton and horticulture farmers sometimes shift into commercial maize production over time, particularly in years when they believe they can capture large government subsidies.

High road. The high road offers a more rapid, but steeper and more difficult ascent. Farmers with the requisite management skills can become truly prosperous within one generation. Exemplified by horticulture production, the high road involves high value farm commodities with commensurately high cash input requirements. Access to the high road depends first on geographic location. Farmers within a 50 to 100 kilometer radius of the major urban markets and with year-round access to water are potentially able to enter horticulture markets.

Although inputs costs impose potentially high entry barriers, horticulture production is scalable. Many of the most prosperous farmers we interviewed started with very small plots, 20 meters square, which they watered with buckets. They used savings, often earned through informal nonfarm work, to finance the first batch of inputs for these very small initial plots. Successful farmers accumulated savings from their horticulture production and increased their scale over time. The median horticulture farmers we interviewed in Chongwe District started with 0.25 hectares of total land under cultivation and advanced over time to 4 hectares.

Most horticulture farmers start by growing rape (kale) because of its low input costs and because rape generates revenue quickly, within six weeks after planting. Well managed, the crop can be harvested every two weeks thereafter over the growing season. Those who succeed with rape move into higher value horticulture products, especially tomatoes. As a result, top-tier horticulture farmers earn three-fourths of their revenue from tomatoes (Table 7). One horticulture farmer explained his transition this way. “Rape helped me start my business. Now I have graduated into tomato and I diversify to minimize danger from price collapses. But the September planted tomato is my diamond mine.” Only a small subset of farmers possess the management skills necessary to navigate successfully to the top tier of tomato producers. Disease problems, product perishability and wide price fluctuations make tomato a highly demanding, risky crop. As one farmer lamented in describing his failed attempt to transition from rape production to tomatoes, “Tomato is a crop that can make you very rich ... or very poor!”

[Table 7]

Successful horticulture farmers invest early in irrigation pumps, pipes and, if electricity permits, boreholes. Some manage sophisticated drip irrigation systems while others use flood irrigation. Small, intermittent horticulture producers face enormous day-to-day price volatility. One farmer ruefully summarized the price risk facing low-volume producers by relating the following experience: “My broker called me on Monday to tell me that pumpkin leaves were selling at a record high price on the Soweto market. So on Tuesday I picked 20 bags and delivered them to the market very early on Wednesday morning. By then, the price had collapsed and I lost everything.”

Ironically, price risk falls dramatically as horticulture farmers scale up production. The high-volume horticulture producers grow tomatoes year round and market multiple times every week. As a result, they typically don’t worry about price variation. They gain on the days when prices spike and lose on days when the prices dip.

Highly disciplined cash management and cash accumulation proves essential to successful horticulture farming. Horticulture farmers require \$400 to \$4,400 per hectare to finance inputs, hire labor and transport their produce to markets. On top of these input requirements, growers require significant financial savings to cushion their business from the inevitable shocks arising from erratic rainfall, disease and price swings. The horticulture farmers we interviewed repeatedly emphasized the need to maintain bank savings or an explicit cash cushion to enable them to restart their business following a catastrophic loss. One highly successful horticulture farmer maintains that he never lets his bank balance fall below 200 million Kwacha (\$40,000). Another put it this way, “If I make 5 million Kwacha (\$1,000), I must put 1 million (\$200) in the bank.” Because this financial cushion enables them to

recover from setbacks, financial institutions, particularly for savings, provide critical support for ensuring generally upward trajectories for commercial smallholders.

After 15-20 years, the best horticulture farmers attain high income for themselves and their family. They accumulate productive assets as well as savings that enable them to withstand periodic setbacks. And they ensure their children's future through heavy investment in education. One proud horticulture farmer told us that his horticulture income had enabled him to marry ten wives. And he insisted that he has sent all of his 27 children to school.

Initial Endowments

The smallholders we interviewed began commercial farming at a range of different ages (Figure 3). To simplify a complex set of alternatives, it is easiest to consider two general cohorts of commercial smallholders: young adults, who begin farming right away as their first major occupation, and middle-age entrants into farming who typically transit first via nonfarm occupations. Roughly two-thirds of the successful commercial smallholders we interviewed began commercial farming as young farmers, under the age of 25. Some began as teenagers, while the majority began farming on their own in their early 20's, usually after short stints as wage laborers or in low-skill nonfarm employment where they earned their start-up capital.

[Figure 3 here]

The remaining one-third began commercial farming after the age of 26, following ten or more years in nonfarm occupations. In most cases, these late entrants began commercial farming as a second career after long-term employment as salaried workers in the mines, in parastatals or in private industry. Some returned to their home villages to begin their commercial farming careers. However, many moved to new locations, usually in pursuit of available land.

Successfully navigating Zambia's land allocation and administration system is an important shared attribute of successful smallholder farmers, both for acquiring initial land to begin farming and acquiring additional land for expansion. Broadly speaking, land in Zambia is regulated through two parallel administrative systems. State land, on which leasehold titles of various durations are permitted, is administered by the central government through the Ministry of Lands. Customary land, on which farmers can only obtain usufruct rights, is administered locally by customary authorities, such as chiefs and headmen. In Zambia the majority of smallholder land is under customary control.

All of the 90 farmers we interviewed began farming on customary land. The young farmers typically began in their home village, on family land. As their commercial farming business expanded, some of the most successful moved to neighboring constituencies to obtain larger land allocations. One highly successful horticulture farmer we interviewed began farming on a small corner of his father's farm before moving to a neighboring headman's village to obtain additional land. After two decades building up a highly profitable horticulture business, he purchased a 400 hectare leasehold farm on state land in Chibombo, 150 kilometers from his home. As a general rule, the top-tier commercial smallholders considered themselves businessmen rather than farmers. In the same way that a businessman moves when the job market requires, these commercial farmers demonstrate a willingness to relocate if necessary to obtain adequate land holdings.

While all of our respondents acquired their initial land endowments in similar ways, via inheritance and communal land allocations, sources of initial start-up financing for purchased inputs varied. The young farmers relied on family loans, casual nonfarm employment or self-employment and trading to finance the purchase of seed, fertilizer and other inputs for very small plots during their first farming season. The mid-career farmers, in contrast, had accumulated savings from their non-farm careers which they invested in inputs and farming assets. Some of the oldest farmers, who began farming in the 1980's, received loans from the Lima Bank or other government-sponsored agricultural lending schemes. For households entering farming from the 1990's onwards, formal bank lending has been largely unavailable.

Investment strategies of successful commercial smallholders

At any given time, most commercial smallholders concentrate primarily on a single commercial crop. Among the top-tier sellers, less than 10% sell multiple crops in high volumes (Figure 4). Although many grow maize in addition to their cash crop, maize often serves primarily as currency to pay laborers and to feed their families. Like good businessmen and women, successful smallholders shift in and out of profitable product lines as market conditions change.

[Figure 4 here]

Farmers who succeed in horticulture typically retain this focus, given the high profitability of horticulture production. Of the successful commercial horticulture farmers we interviewed, roughly 90% began in horticulture and remain selling primarily horticulture products today (Table 8). A few have used their horticulture earnings to finance large-scale commercial maize production in 2011 in anticipation of large price subsidies from the FRA during an election year. Notably, most of them indicated that they would not produce maize for sale were it not for the government subsidies.

[Table 8]

In contrast, farmers growing low-value crops such as cotton and maize often shift from one commercial crop to another in response to changing price incentives. A minority of 13% to 24% of the farmers we interviewed have parlayed their startup maize and cotton earnings into horticulture production (Table 12). Given that commercial horticulture is only feasible for a restricted geographic subset of farmers, the majority of farmers starting with cotton or maize have shifted back and forth over time between these two low-value crops, driven by wide swings in relative prices. Over the past decade alone, the price of cotton relative to the price of maize has ranged between 1 and 3.5 (Figure 5).

[Figure 5 here]

As a result of these rapidly shifting incentives, the top commercial maize and cotton farmers change over time. Of the farmers accounting for the top half of maize sales in 2000, only one-third remained in the top tier in 2003, while roughly another third fell into the group accounting for the bottom half of sales, and the remaining third stopped selling maize altogether (Table 13). During the period from 2003 to 2007, when the FRA resumed large-scale purchasing at above-market prices, about half remained in the top tier and only about 15% stopped selling maize. The farm household panel survey data suggests that farmers who

exited the top-tier of maize sellers did so intentionally, by reducing area planted to maize (Table 9).

[Table 9 here]

Movement among cotton farmers reveals similar patterns. Between 2003 and 2007, after the cotton price collapse of 2006 and the surge in support to the maize sector, about one-third of cotton farmers stopped growing cotton altogether (Table 10).

[Table 10 here]

To diversify outside of agriculture, most successful smallholders use commercial farm profits to finance agribusiness investments in transport, milling, rippling services or in purely nonfarm investments such as retail shops, bakeries, rental housing and guest houses. In addition to spreading risk, this diversification enables them to translate lump-sum annual field crop profits into nonfarm businesses that generate year-round revenue streams.

Rebounding from setbacks

Commercial smallholders face a host of risks. Horticulture farmers, in particular, remain acutely aware of both disease problems and price risks, either of which can cause total losses on a given field. As one horticulture farmer explained, “With vegetables, it’s win and lose.” Maize farmers face price risk and well as production risk, particularly during drought years. Because cotton is more drought-tolerant than maize, cotton farmers fear primarily price risks. Indeed, they have seen wide swings in the past decades.

As a result, successful commercial smallholders repeatedly emphasized the importance of building up their capacity to absorb and rebound from shocks. Many prepare by building up financial reserves and livestock assets, both of which provide savings that enable them to resume commercial farming following a catastrophic season. One farmer explained that her success hinges on, “planning well and having chickens to fall back on when sales are poor due to price collapse.”

Where banks are available, they shelter funds far from prying relatives. The successful horticulture farmers, who travel frequently to town for marketing, often secure their funds in commercial bank accounts. Mobile money transfer systems, common elsewhere in Africa, are only just now emerging in rural Zambia. Where formal savings institutions are unavailable, farmers keep a cash reserve in a special hiding place in their house, separate from normal transactional cash.

Common characteristics of successful commercial smallholders

In concluding our interviews, we asked each of our respondents what characteristics have enabled them to succeed as commercial farmers and, in contrast, why so many others failed. In response, they identified four major distinguishing traits.

Discipline. The importance of hard work and discipline came through repeatedly. Successful farmers described themselves as “hard working,” “God-fearing” and “serious.” In contrast, many considered their unsuccessful neighbors to be “lazy”. As one said, “Some farmers are

playful, womanizing and drinking too much. They do not succeed in farming.” Another farmer elaborated, “They drink too much beer and do not budget.”

Treat farming as a business. Most commercial smallholders explicitly stated that they consider farming a business. This translates in a willingness to shift into profitable crops and out of less profitable ones. It translates into a willingness to move to more promising location if land availability, electricity or market access dictate. This business-like attitude, combined with the willpower to defer immediate consumption, translates into a strong propensity to invest in their farming business.

Good managers. Successful commercial smallholders require strong management skills, for supervising crop production, labor and finances. Horticulture and cotton, in particular, demand precise agronomics and careful farm management. But good agronomic practices are not sufficient. Successful commercial farming also requires the ability to manage and supervise hired labor. Poor spraying or crop harvesting can reduce crop quality and revenue. Most handle critical activities such as spraying themselves, or delegate it only to long-time, trusted employees. As one told us, “You have to be in the fields.”

Finally, they must manage their finances assiduously. Farmers repeatedly emphasized the importance of budgets and planning. One farmer said simply, “I sit down to plan.” Another said, “I do budgeting.” Asking about farmers who fail, we learned, “They don’t make a plan.” While horticulture provides a steady flow of revenue throughout most of the year, cotton and maize do not. So farmers of annual crops must very carefully budget these lump-sum revenues to cater for expenses arising throughout the year. Many diversify into retailing, transport and real estate to generate a steady year-round cash flow to meet expenses as they come due. Most agree that the discipline to build up financial reserves constitutes a key difference between successful commercial smallholders and those who audition but fail.

Invest in their children. All but one of the farmers we interviewed hired labor specifically to enable their children to go to school. Data from Zambia’s national farm household surveys underline this propensity. The top-tier commercial smallholders clearly invest more in their children’s education than others (Table 11). Part of their long-term business plan involves launching their children on successful non-farm trajectories. We heard many variants of the following refrain, “I want my children to be teachers or shop owners or maybe vice president.”

[Table 11 here]

INSTITUTIONAL STRUCTURE

Institutions affecting farm productivity

Land. For historical reasons, Zambia operates a dual set of land allocation systems: a customary tenure system managed by tribal elders and headmen and a system of leasehold state lands managed by the central government’s Ministry of Lands. Over time, population growth in the customary areas is leading to land pressure and land fragmentation. This increases the difficulty farmers face in consolidating contiguous land allocations of sufficient scale to support commercial farming. In response, some commercialized smallholders are transferring their customary usufruct rights to leasehold tenure systems as permitted under the

1995 Land Act. Many of the farmers we interviewed confront this problem by moving to areas where land remains available.

Over time, as farmers move to high-value agriculture – such as horticulture, poultry and dairy production – land requirements fall. So land constraints affect primarily the low-road farmers trying to scale up cultivated area sufficiently to generate a prosperous existence from low-value crops such as cotton and maize.

Input credit. Zambia's formal credit system virtually stopped lending to agriculture for a decade or more following the structural adjustment reforms of the late 1980's. As a result, successful farmers instead finance inputs from nonfarm earnings, family loans or contract farming schemes.

Contract farming schemes – for cotton, sugar cane, tobacco and, for a time, paprika – all provide input credit to farmers for specialized crops with limited market outlets. Where single buyers can prevent side selling, these systems work well (Dorward, Kydd and Poulton 1998, Tschirley et al. 2009). With the proliferation of cotton companies in recent years, side selling has surfaced as a problem which the Cotton Board and ginners have organized to police. Clearly, one key attraction of cotton farming is the absence of any cash requirements for input financing.

Maize, in contrast, is a low-value, high-input crop. Given an absence of input financing for maize, poor farmers are rarely able to launch commercial farming careers as maize farmers. Instead, the poor transit first via cotton and then move into maize during years when their finances permit and when prices make it attractive.

Horticulture farmers face enormous input costs by comparison, and they do so primarily using reinvested profits from their farming businesses. Given scalability, they build up horticulture production slowly over time. Their key cash input constraint occurs during the first year of crop production. After that, farmers must manage their cash flows, financial savings and nonfarm investments in ways that ensure the ability to self-finance farm inputs while maintaining a cash reserve to weather adverse harvests or prices.

Savings institutions. The financial capacity to absorb shocks, recover and reconstitute production following a catastrophic loss represents one of the defining characteristics of successful commercial smallholders. Farmers who build up a financial cushion or fungible livestock assets are able to rebound and rebuild in the aftermath of a major drought, disease outbreak or price collapse. Institutions that support both forms of savings help to advance prospects for successful smallholder commercialization. Control of contagious livestock diseases is a public good that helps to shelter the livestock assets of vulnerable as well as currently prosperous farm households. For financial savings, formal sector banks provide secure savings for the most successful horticulture farmers, who make regular marketing forays into towns. However, the generally more remote cotton and maize farmers must instead rely on hiding cash in and around their homestead. The recent emergence of mobile money transfer and savings schemes in Zambia offers potentially important vehicles for farmers to secure the financial savings necessary to their commercial survival.

Management. Discipline and good management separate the successful commercial smallholders from those who fail. Specific training and mentoring can help to build the required management skills in crop agronomics, labor and financial management. Currently,

the cotton companies offer the most widely available support system. They explicitly recruit disciplined farmers into their groups and designate the best as lead farmers. They monitor performance and weed out nonperformers. They provide training for service providers as well as regular agronomic extension advice at critical periods during the cropping season. They promote the best performing managers to higher and higher levels of responsibility. The system is built to filter out weak performers and assist the better performers to advance.

In horticulture, limited agronomic support is available, though mostly for the high-volume farmers who seek advice from input suppliers or from the handful of sophisticated agribusiness enterprises that have emerged to sell hybrid seedlings to large- and medium-scale producers. Meanwhile, maize farmers rely on the government extension service. In some locations, the Conservation Farming Unit has helped improve agronomic management of smallholder maize and cotton farmers, though funding was limited before 2006.

Markets

Horticulture markets have always remained the province of private sector brokers, traders and farmers. In cotton markets, private ginning companies have likewise managed domestic cotton markets since the dissolution of agricultural parastatals in the early 1990's.

These private markets, however, require public support. Urban wholesale markets for horticulture products provide generally deplorable infrastructure, inadequate zoning and impose consequently heavy losses on farmers, particularly during the rainy season. Ongoing discussions between market brokers, city governments and town planners aim to help provide the public zoning and infrastructure required to facilitate continued rapid growth of the sector. In cotton markets, too, recent problems with side selling have motivated industry collaboration with government, resulting in the enactment of the 2005 Cotton Act and the establishment of a Cotton Board provides to help regulate side selling and enforce input supply contracts.

In maize markets, government's Food Reserve Agency (FRA) has gained increasing market share since the mid 2000's. By 2007, the Food Reserve Agency purchased 60% of maize sold made by the top-tier commercial smallholders (Chapoto et al. 2012). The FRA generally pays a premium above market prices, 20% to as much 50% higher in some areas according to the farmers we interviewed. This price premium results in the transfer of large rents to the generally well-off rural households who supply the bulk of maize to the FRA (Jayne et al. 2011). To collect this premium, farmers selling to the FRA must have the financial capacity to withstand sometimes substantial delays in payment. As of late January 2012, two months after most farmers began planting, local newspapers reported that the FRA still owe 198 billion kwacha (approximately US\$ 39.6 million) to farmers from the previous marketing season (Zambia Daily Mail. January 24th 2012). Only the most affluent farmers can afford payment delays of this magnitude and duration. As one farmer told us, "With cotton you get paid in cash at harvest time. But when selling maize to the FRA you must wait long. Sometimes you can even die."

CONCLUSIONS

Many are called, but few are chosen. Although a majority of Zambians work in agriculture, only a small minority of smallholders succeed in transitioning to high-productivity, high-

value commercial agriculture. Only about 20% of cotton farmers and less than 5% of maize and horticulture farmers succeed as top-tier commercial growers.

Among those who succeed as commercial smallholders, two pathways predominate. The low road, exemplified by cotton production, involves low value output and low cash input costs. Given widespread input lending and extension support from ginning companies, cotton provides an entry point for large numbers of poor but disciplined farmers with little nonfarm income. The best managers grow their cotton business over time. Although low value crops such as cotton (and maize) cap farm earnings at modest levels, successful farmers use cotton revenues to finance entry into higher-input agriculture and to educate their children, thus opening new pathways to high-wage nonfarm employment for the next generation.

The high road, exemplified by horticulture production, involves high value products with commensurately high cash input requirements. Small initial savings finance inputs for very small horticulture plots. Successful farmers accumulate savings and increase their scale over time. After 15-20 years, the best attain high incomes, accumulate savings that enable them to withstand periodic setbacks, and ensure their children's future through heavy investment in education.

Successful commercial farming requires highly disciplined management of crop agronomics, hired labor and finances. Among the three commodity groups we studied, only the cotton farmers enjoyed systematic extension support aimed at building up these requisite skills. The major ginners provide regular agronomic support to their farmers through cotton schools, lead farmers and training of specialized service providers. They emphasize farmer recruitment, youth leadership training and development of management skills through a system of lead farmers, sub-leaders and deliberate mentoring. By combining performance bonuses with gradual promotion and demotion, they systematically cultivate and groom the best managers for positions of increasing responsibility. Individual farmers then transfer these skills to other arenas, making the cotton schools important incubators for successful commercial farmers and agribusiness entrepreneurs.

Careful cash management and savings, likewise, prove essential for financing inputs, hiring labor and cushioning commercial smallholders against shocks from erratic rainfall, episodic disease outbreaks and unpredictable price swings. As a result, financial institutions, particularly for savings, can provide critical support for successful smallholder commercialization.

From a policy perspective, cotton provides a very broad on-ramp and horticulture a more narrow but very steep on-ramp to the roadways out of poverty -- both at little cost to the government budget. Cotton helps farmers with little start-up capital who are geographically disadvantaged. Horticulture provides opportunities to farmers who are geographically lucky enough to live near surface water and urban centers. Meanwhile, maize provides a broad low road up the mountain, but no on-ramp for the poor. At enormous cost to the public treasury, maize production offers a profitable alternative for well-established farmers with sufficient land, cattle and equipment to farm large blocks of land in a low-value crop. In 2011, the Zambian government spent \$100 million on maize procurement alone. Investment of some of these funds in public goods such as improved infrastructure for urban horticulture markets, rural electrification in high-potential horticulture zones, a stronger Cotton Board and cotton research could generate significant payoffs. Zambia's past policies of lavish spending on maize have not succeeded in reducing rural poverty (Jayne et al. 2011). Less expensive

alternative investments in cotton and horticulture may generate higher payoffs by enlarging available agricultural pathways out of poverty for commercial smallholder farmers.

Table 1. Alternate Institutional Models for Agricultural Commercialization

	Key institutional support	Input supply	Output marketing
Maize	public	Fertilizer Support Programme (FSP)	Food Reserve Agency (FRA)
Cotton	private	input credits from ginneries	contract sales to ginneries
Horticulture	none	individual farmers self finance inputs	farmers, assembly traders and private brokers manage marketing

Table 2. Concentration of Marketed Sales, 2007

Farm category	Percent of Small and Medium Farms		
	Maize	Cotton	Horticulture
All farms			
Growers	76	9	38
Sellers	26	9	18
Sales distribution among growing households			
Top half of sales	3	20	1
Bottom half of sales	36	80	46
Growers with no sales	62	0	53
Total growers	100	100	100
Source: Supplemental Farm Household Survey 2008.			

Table 3. Characteristics of Commercial Smallholder Households in Zambia, 2007														
	Sales		Assets					Income per capita (US dollars)				Female- headed households	Education	
	kg* per capita	kg* per hh	Household size	Farm size		Cattle per hh	Farm assets per capita (USD)	Total	Crop	Livestock	Nonfarm		Head of household	Household maximum
				owned (ha/hh)	cultivated (ha/capita)									
Maize														
Top half of sales	1,664	11,091	7.9	13.5	0.9	12.1	301	841	498	81	236	10%	8.1	10.0
Bottom half of sales	167	856	6.1	4.1	0.4	2.2	52	250	121	15	100	18%	6.2	8.1
Growers with no sales	0	0	5.8	3.2	0.3	1.7	52	171	78	19	62	26%	5.0	7.2
Total maize growers	105	609	6.0	3.7	0.3	2.1	59	218	105	19	80	23%	5.5	7.6
Cotton														
Top half of sales	319	1,918	7.5	6.7	0.6	5.9	77	325	219	40	58	5%	5.5	8.0
Bottom half of sales	95	486	6.2	3.5	0.4	2.5	24	136	90	14	28	17%	4.8	6.7
Total cotton growers	141	778	6.5	4.1	0.5	3.2	35	174	116	19	34	14%	4.9	7.0
Horticulture														
Top half of sales	942	7,564	8.3	10.3	0.6	4.7	210	1,389	1,193	41	149	12%	6.2	7.9
Bottom half of sales	31	167	6.6	4.0	0.3	2.6	41	221	113	20	76	16%	6.1	8.1
Growers with no sales	0	0	5.7	2.9	0.3	1.3	31	187	93	7	73	22%	5.3	7.1
Total horticulture growers	24	156	6.2	3.4	0.3	2.0	37	215	114	14	75	19%	5.7	7.6
* horticulture sales in US dollars														
Source: Supplemental Farm Household Survey 2008.														

Table 4. Productivity Differences Across Seller Groups in Zambia, 2007

Seller category	Area planted (ha/crop)	Output Productivity		Input Use	
		yield (kg/ha)	value (USD/ha)	fertilizer (kg/ha)	hybrid seed
Maize					
Top half of sales	4.8	3,393	571	247	97%
Bottom half of sales	1.1	2,074	413	175	56%
Growers with no sales	0.8	1,161	197	64	31%
Total maize growers	1.0	1,547	285	109	41%
Cotton					
Top half of sales	1.5	1,581	481	2	n.a.
Bottom half of sales	0.8	822	179	0	n.a.
Total cotton growers	0.9	975	240	0	n.a.
Horticulture					
Top half of sales	0.6	n.a.	6,974	0	n.a.
Bottom half of sales	0.2	n.a.	683	0	n.a.
Growers with no sales	0.0	n.a.	79	0	n.a.
Total horticulture growers	0.1	n.a.	731	0	n.a.
n.a. = not applicable					
Source: Supplemental Farm Household Survey 2008.					

Table 5. Crop Values and Input Costs in 2011 Prices (US dollars per hectare)

Farmer categories	Input costs (\$/ha)	Yield (kg/ha)	Output value (\$/ha)
Maize			
Top 50% of sales	261	3,393	625
Bottom 50% of sales	202	2,074	382
Cotton			
Top 50% of sales	28	1,581	1,012
Bottom 50% of sales	27	822	526
Horticulture			
Rape (kale)	400	n.a.	1,600
Tomato, from seeds	1,600	n.a.	7,000
Tomato, hybrid seedlings	4,400	n.a.	14,000
Source: yields from Table 4, input costs from Haggblade, Kabwe and Plerhoples (2011), horticulture budgets from field interviews.			

Table 6. Probit Estimates of the Determinants of Top Commercial Maize, Cotton and Horticulture Farmers

Explanatory variables	Probit Regressions for Sellers Accounting for the Top 50% of Sales, Marginal Effects		
	Horticulture	Cotton	Maize
<i>Household demographic characteristics</i>			
Male headed household	-0.0017 (0.0025)	0.0896** (0.0379)	0.0134*** (0.0034)
Age of household head (years)	-0.0001** (0.0001)	-0.0009 (0.0011)	0.0001 (0.0001)
Education of household head (years)	0.0004* (0.0002)	0.0094** (0.0042)	0.0017*** (0.0004)
<i>Social capital and migration</i>			
Household social ties to headman	-0.0013 (0.0017)	-0.0332 (0.0278)	-0.0053* (0.0032)
Years living in settlement	-0.0002** (0.0001)	-0.0006 (0.0012)	0.0001 (0.0001)
<i>Assets, lagged (prior survey year)</i>			
Landholding size (ha)	0.0001 (0.0001)	0.0240*** (0.0048)	0.0037*** (0.0004)
Cattle owned (number)	0 0.0000	0.0045*** (0.0015)	0.0001** (0.0001)
Small livestock owned (number)	0 (0.0001)	0.0013 (0.0019)	0.0002 (0.0002)
Own water pump (yes=1)	0.0388 (0.0236)	-0.1676*** (0.0386)	0.0063 (0.0111)
Farm equipment owned (yes=1)	0.0062 (0.0043)	0.1097*** (0.0391)	0.0271*** (0.0074)
Own a vehicle (yes=1)	0.0115 (0.0101)	0.2859* (0.1509)	0.0544** (0.0212)
<i>Location</i>			
Proximity to major cities (=1 for districts contiguous to Lusaka, Kitwe or Chipata)	0.0060* (0.0033)	0.0236 (0.0357)	0.0004 (0.0039)
Distance to vehicular transport (km)	-0.0001 (0.0001)	-0.0032* (0.0018)	-0.0001 (0.0002)
Distance to FRA depot (km)			-0.0002** (0.0001)
<i>Management skills</i>			
Plot management (production function residuals)		0.0941*** (0.0134)	0.0096*** (0.0009)
Years growing cotton		0.0257*** (0.0056)	
Number of observations	4,025	1,032	7,036
<p>Notes:</p> <p>Standard errors are listed in parentheses below coefficients</p> <p>Significance levels: *** p<0.01, ** p<0.05, * p<0.1</p> <p>Small livestock: sum of pigs, goats and sheep</p> <p>Farm equipment: households owning a harrow, cultivator, disk plow, scotch cart or spray pump</p> <p>Source: Probit regressions using national farm household surveys from 2001, 2004 and 2008.</p>			

Table 7. Composition of horticulture products, by seller group							
Category of horticulture farmers	Value of Sales, by Product						
	tomato	rape	cabbage	onion	other veg	fruits	total
Top half of sales	74%	9%	3%	1%	5%	8%	100%
Bottom half of sales	34%	29%	12%	4%	11%	10%	100%
Total horticulture sellers	54%	19%	7%	3%	8%	9%	100%
Source: Supplemental Farm Household Survey 2008.							

Table 8. Shifting Strategies of Commercial Smallholders

Start-up crop	Current commercial crop				
	maize	cotton	horticulture	other	total
maize	43%	33%	24%	0%	100%
cotton	25%	63%	13%	0%	100%
horticulture	12%	0%	88%	0%	100%
other	0%	100%	0%	0%	100%
Source: life history interviews with 90 commercial smallholders.					

Table 9. Shifting Cropping Strategies of Top Selling Maize Farmers

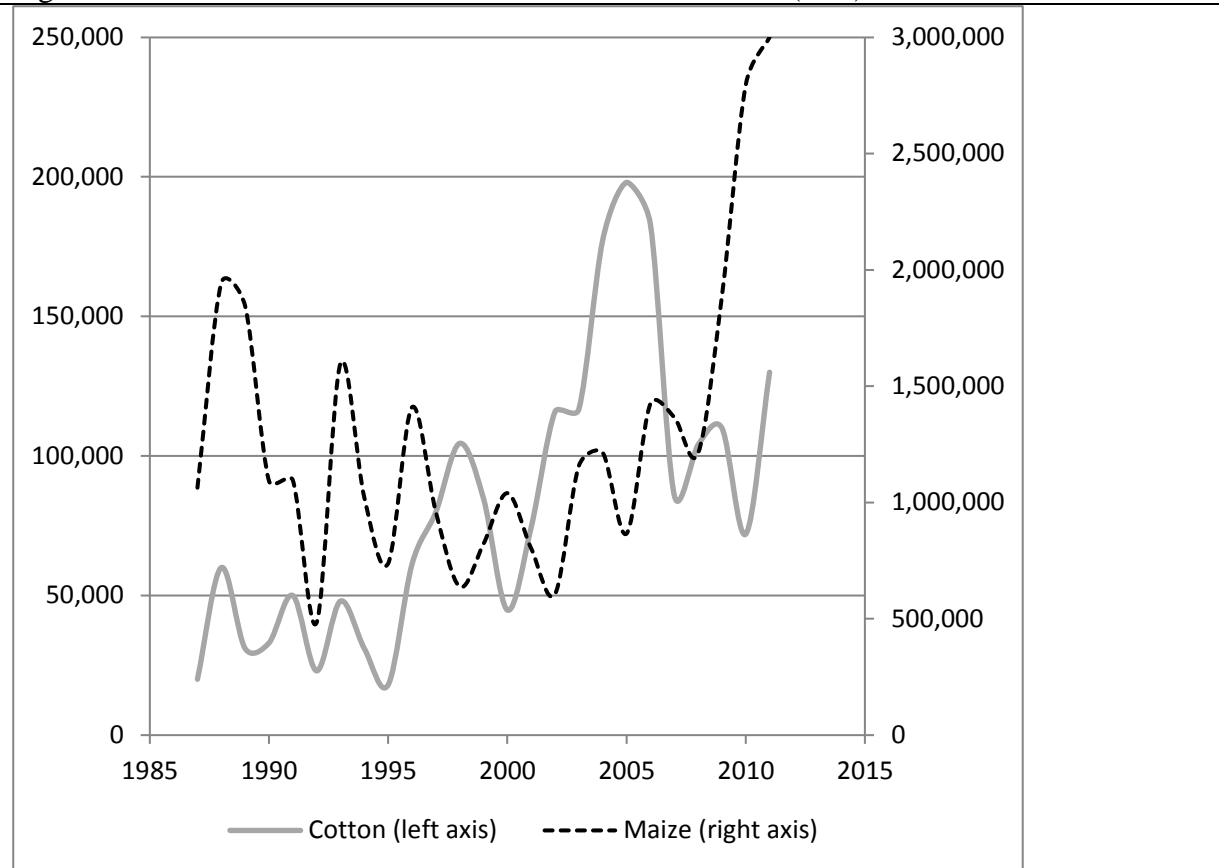
	Percent of top sellers	Percent change in maize area
Top maize selling households, 2000 to 2003		
Still in top 50% of sellers	33%	10%
Fall to bottom 50% of sellers	38%	-35%
Stop selling maize	29%	-58%
Total	100%	
Top maize selling households, 2003 to 2007		
Still in top 50% of sellers	47%	42%
Fall to bottom 50% of sellers	38%	-32%
Stop selling cotton	16%	-56%
Total	100%	
Source: Supplemental Farm Household Surveys of 2001, 2004 and 2008.		

Table 10. Shifting Cropping Strategies of Top Selling Cotton Farmers		
	Percent of top sellers	Percent change in cotton area
Top cotton selling households, 2000 to 2003		
Still in top 50% of sellers	50%	53%
Fall to bottom 50% of sellers	36%	0%
Stop selling cotton	14%	-57%
Total	100%	
Top cotton selling households, 2003 to 2007		
Still in top 50% of sellers	32%	5%
Fall to bottom 50% of sellers	33%	-64%
Stop selling cotton	35%	-100%
Total	100%	
Source: Supplemental Farm Household Surveys of 2001, 2004 and 2008.		

Table 11. Educational Investments by Smallholder Farmers in Zambia

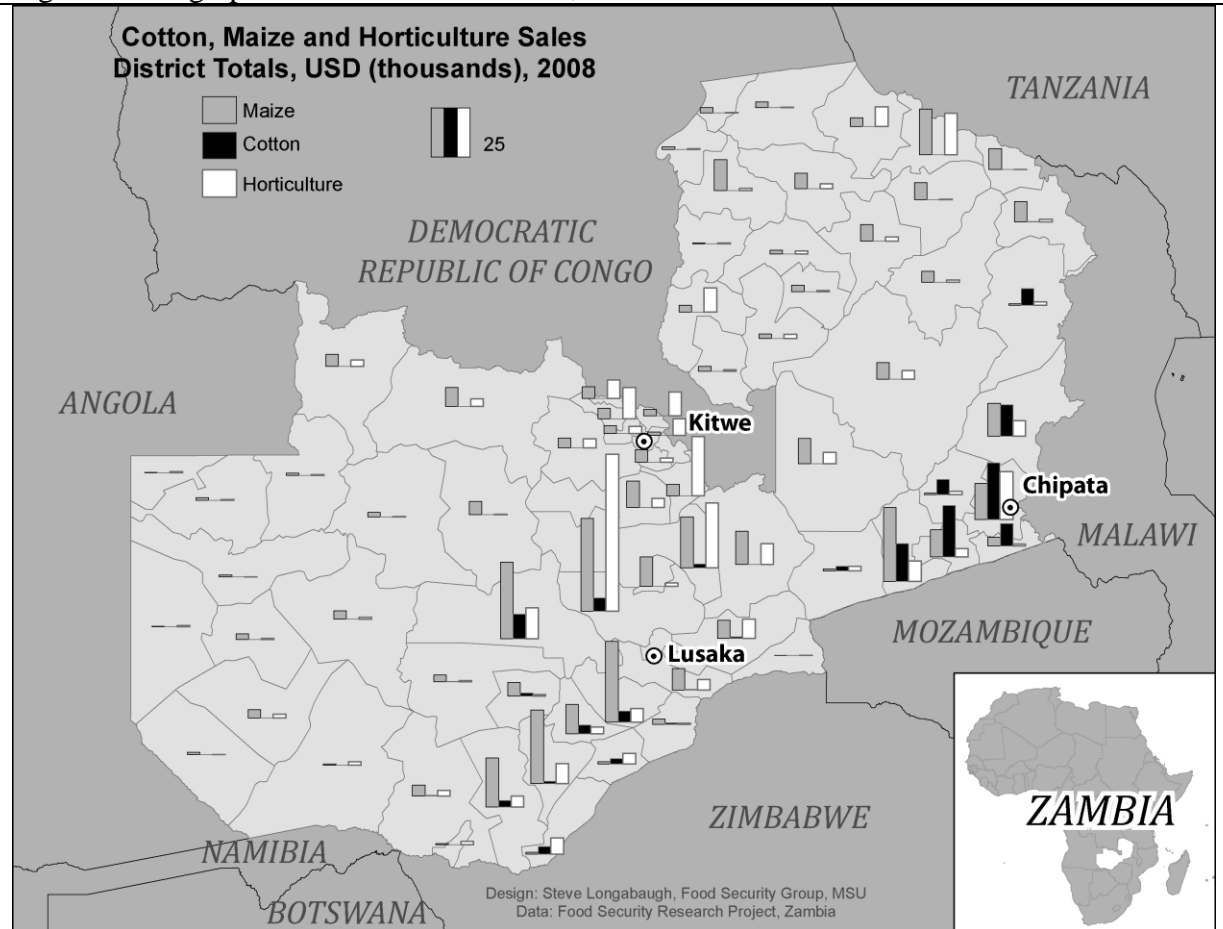
Farmer category	Percentage of school-age children in school	Children's educational attainment as percent of expected
Maize		
Top half of sales	78	67
Bottom half of sales	70	59
Growers with no sales	64	53
Cotton		
Top half of sales	70	59
Bottom half of sales	61	48
Horticulture		
Top half of sales	76	65
Bottom half of sales	70	58
Growers with no sales	65	54
Source: Supplemental farm household surveys of 2004 and 2008.		

Figure 1. Trends in Maize and Cotton Production in Zambia (tons)



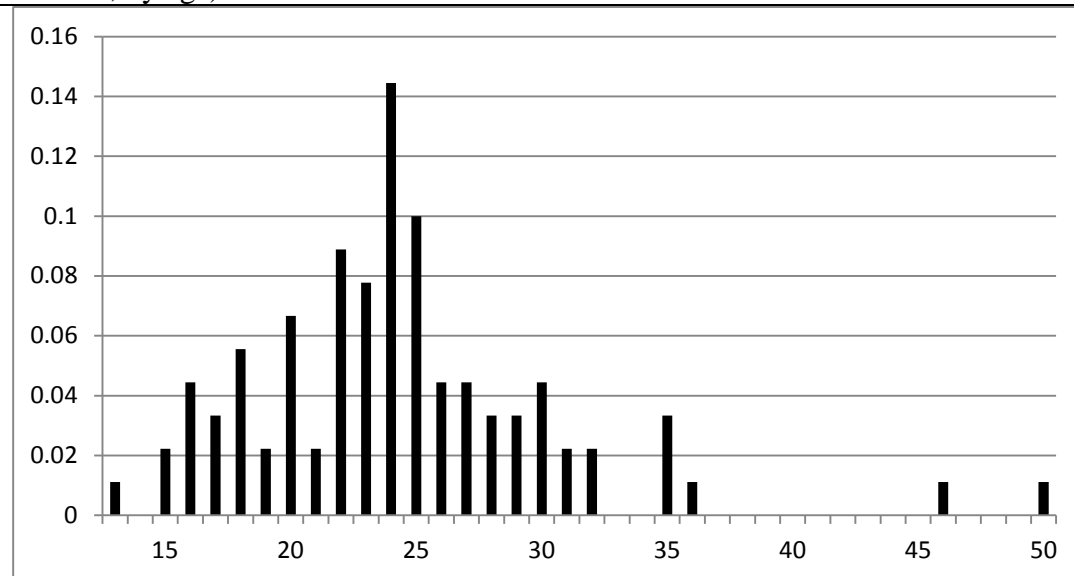
Source: Cotton Board of Zambia and FAOSTAT.

Figure 2. Geographic Distribution of Maize, Cotton and Horticulture Sales



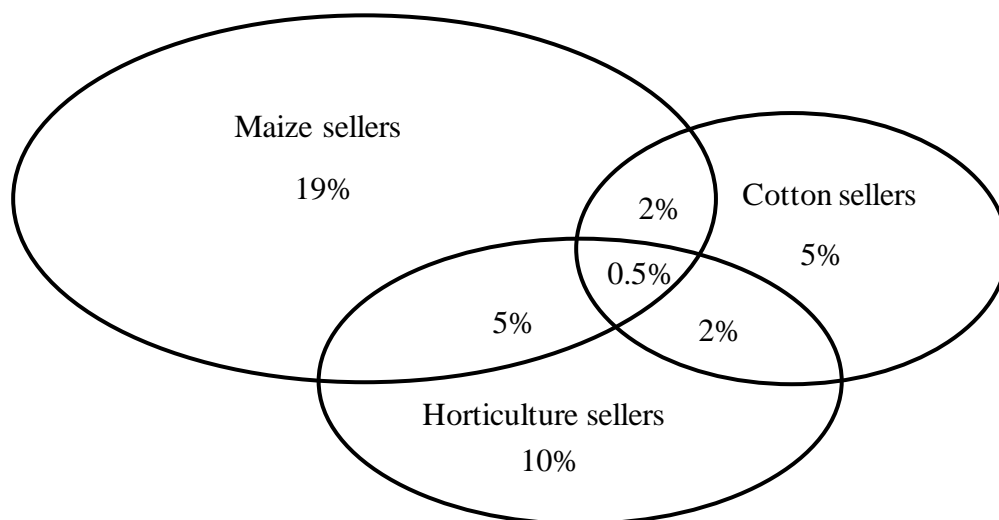
Source: Post Harvest Survey of 2008.

Figure 3. Age of Farm Start-Up Among Successful Commercial Smallholders (percent of farmers, by age)

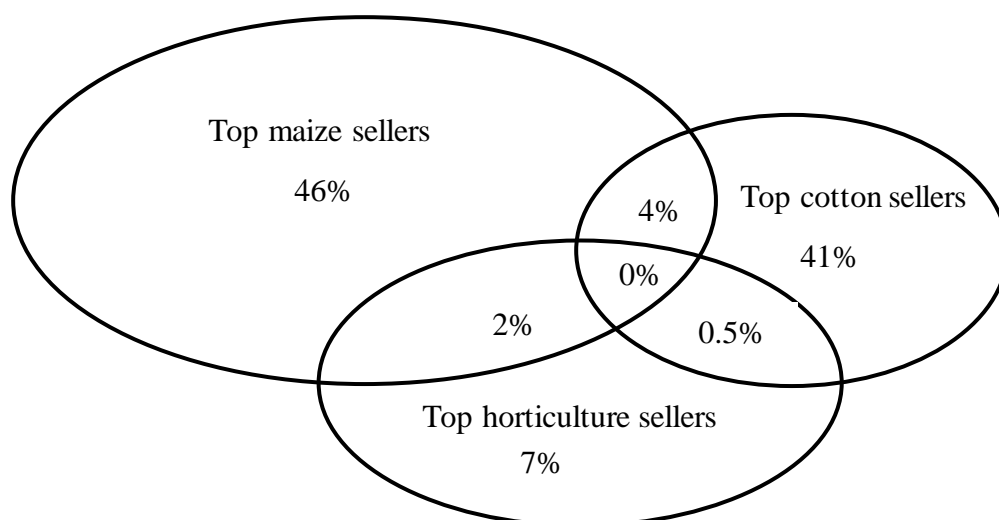


Source: life history interviews with 90 commercial smallholders.

Figure 4. Percent of Smallholder Farmers Selling Maize, Cotton and Horticulture, 2007



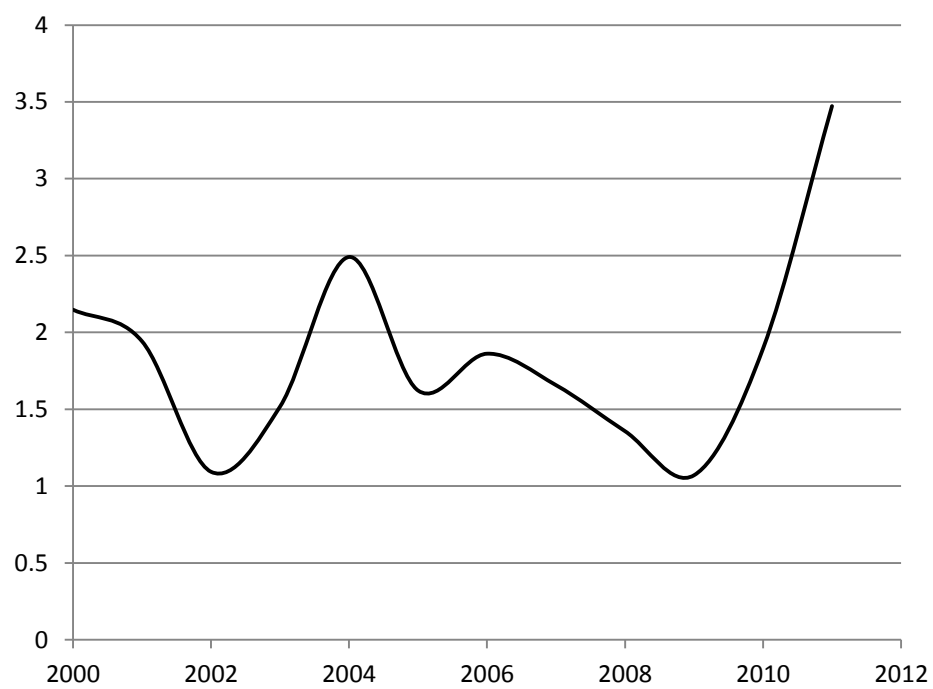
a. Percentages of all smallholder households



b. Percentage of the 70,000 smallholder households accounting for the top 50% of maize, cotton and horticulture sales

Source: Supplemental Farm Household Survey 2008.

Figure 5. Price of Cotton Relative to the Price of Maize (Pc/Pm)



Source: Cotton Board of Zambia and Agricultural Market Information Centre.

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